FIG. **21** depicts a steered beam switching system **200** according to a second embodiment of the invention. If port count becomes sufficiently on module **100**, large losses may occur due to light entering the fibers at two great an angle. To overcome this, the system **200** that utilizes two modules of the type shown in FIG. **21** to ensure that beam **101** enters the output fiber at the correct angle.

The system **200** generally comprises a first module **210** coupled to an N×M input fiber array **202** and a second module **220** coupled to an output fiber array **204**. Modules **210** and **220** determine, at the plane of output fiber array **204**, the position and angle of an optical beam emerging from any of the input fibers in input fiber array **202**. Modules **210** and **220** have features in common with module **100** of FIG. **21**. Module **210** comprises single axis mirror arrays **212**, **214** and relay optics **216**. Mirrors in arrays **212** and **214** rotate about mutually orthogonal axes. Module **220** comprises single axis mirror arrays **222**, **224** and relay optics **226**. Mirrors in arrays **222** and **224** rotate about mutually orthogonal axes.

In the exemplary embodiment depicted in FIG. **22** mirrors in arrays **214** and **222** rotate about substantially parallel axes. A light beam **201** from a fiber **203** in input fiber array **202** couples to a corresponding mirror **213** in mirror array **212**. Mirror **215** steers light beam **201** to a mirror **215** in array **214**. Relay optics **216** preserve the angle that light beam **201** makes at with respect to an image plane of relay optics **216**. Mirror **215** deflects light beam **201** to a mirror **223** on array **222**. Mirror **223** steers light beam **201** to a mirror **225** in array **224**. Relay optics **226** preserve the angle that light beam **201** makes at with respect to an image plane of relay optics **226**. Mirror **225** deflects light beam **201** to a corresponding fiber **205** in output fiber array **204**.

Those skilled in the art will recognize that by suitable manipulation of mirrors **213**, **215**, **223**, and **225** any fiber in input array **202** may be coupled to any fiber in output array **204**.

An exemplary embodiment of an optical switch **2300** employing various features described above is depicted in FIGS. **22** and **23**. The switch **2300** generally comprises a plurality of beam steering modules **2302** attached to a case **2301**. The modules are disposed along a curved upper surface of the housing **2301**. Each beam steering module **2302** includes beam steering elements made up of alternating stacked arrays x-axis and y-axis beam steering mirrors **2304** **2308**. By way of example the beam steering mirrors **2304** may be single axis mirrors that alternately rotate about x and y axes. The beam steering mirrors **2304** may be electrically connected to a controller by ribbon cables **2305**, which are not considered part of the modules **2302**. Optical signals from optical fibers **2303** are coupled to the beam steering elements by N×M groups of collimators **2306** disposed in holes in housings **2307** mechanically coupled to modules and optically coupled to beam steering elements. For clarity, some of the housings are have been removed to expose the beam steering elements. The modules are optically coupled to each other via a fold mirror **2310**, which is fixed to the case **2301**.

It will be clear to one skilled in the art that the above embodiment may be altered in many ways without departing from the scope of the invention. For example, although in the above embodiments, the mirrors are described as MEMS mirrors other mirrors such as bulk mirrors or large-area deformable mirrors may be used. Accordingly, the scope of the invention should be determined by the following claims and their legal equivalents.

What is claimed is:

1. A beam steering module comprising:

one or more beam steering elements including a first and second deflector array, wherein the one or more beam steering elements deflect one or more optical signals in two dimensions,

wherein one or more of the first and second deflector arrays includes an L×M array of deflectors, where L and M are integers greater than or equal to one

wherein N first and second deflector arrays are stacked to form an N×L×M beam steering module, where N is an integer greater than or equal to 1.

wherein one or more of the beam steering elements includes a frame, wherein the first and second deflector arrays are coupled to opposite sides of the frame in a staggered configuration.

2. The module of claim **1** wherein the frame includes one or more holes between the two or more arrays on at least one side of the frame.

3. A beam steering module comprising:

one or more beam steering elements including a first and second deflector array, wherein the one or more beam steering elements deflect one or more optical signals in two dimensions

wherein one or more of the first and second deflector arrays includes an L×M array of deflectors, where L and M are integers greater thanor equal to one wherein N first and second deflector arrays are stacked to form an N×L×M beam steering module, where N is an integer greater than or equal to 1, wherein at least one of the first and second deflector arrays is a double-sided array.

4. The module of claim **3**, wherein the double sided array includes two substrates back-to-back, wherein each substrate has one or more deflectors on one side.

5. The module of claim **4** wherein the back-to-back substrates are separated by an air gap.

6. The module of claim **3**, wherein the double sided array includes a single substrate having one or more deflectors on each side thereof.

7. The module of claim **3** wherein the first array includes one or more deflectors configured to rotate about a single first axis.

8. The module of claim **7** further comprising relay optics optically coupled to one or more of the first and second deflector arrays.

9. The module of claim **7** wherein the second array includes one or more deflectors configured to rotate about a single second axis.

10. The module of claim **9** wherein the first axis is substantially perpendicular to the second axis.

11. The module of claim **9** wherein the deflectors in the first and second arrays are optically coupled in a one-to-one correspondence.

12. The module of claim **9** wherein N first and second deflector arrays are stacked.

13. The module of claim **9** further comprising relay optics optically coupled to one or more of the first and second deflector arrays.

14. The module of claim **7** wherein the double-sided array includes one or more deflectors on one side configured to rotate about a first axis and one or more deflectors on another side configured to rotate about a second axis.

15. The module of claim **7** wherein N of said double-sided arrays are stacked, wherein N is an integer greater than 1.